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Where are we now? Reconsidering interactive text features and their role in the classification of digital books as considerate or inconsiderate

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Dissertation

WHERE ARE WE NOW?
RECONSIDERING INTERACTIVE TEXT FEATURES AND THEIR ROLE IN THE CLASSIFICATION OF DIGITAL BOOKS AS CONSIDERATE OR INCONSIDERATE

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DEDICATION

I would like to dedicate this dissertation to my incredible husband John, and my voracious little readers, Hanora and Manus – it is for them who I will continue to keep doing the good fight.

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ABSTRACT

This dissertation presents an updated content features analysis on high-quality digital book versions of printed books. In a time where mobile devices (i.e., iPad, iPhone, Android phones) are ubiquitous, current research on the quality of digital books read on these devices have been sparse. With children having access to these mobile devices to play games, read digital books, listen to music, and watch shows, an updated study on the quality of digital books read on these devices is needed. Using the considerate/inconsiderate framework, the terms integral (vital or corresponding actions), incidental (additional or plausible actions), and incongruent (disparate and illogical actions) were used to describe whether the interactive media features in the 20 high-quality digital books were supportive in meaning-making. Those designations led to an evaluation of whether each digital books –as a whole—was supportive or nonsupportive of comprehension. Analysis showed that all of the high-quality printed version of digital books produced by Oceanhouse Media and two from Loud Crow Interactive were considerate (i.e., supported meaning-making for young children). Findings from this

study confirm the utility of the considerate/inconsiderate framework as an analytic tool for evaluating the potential of using high-quality digital book versions of printed books for instructional practices. Furthermore, the dissertation shows how the findings from this study could inform the development of an evaluative tool for educators and researchers to identify high-quality digital books for classroom use and support the categorization of types of available digital books, respectively. Finally, findings point to the need for further research on whether the considerate/inconsiderate framework holds merit for evaluating digital books from a range of quality levels not just high-quality digital book versions of printed books.

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CHAPTER ONE: INTRODUCTION

Statement of the Problem

According to Dale (2017), electronic books are a growing market; despite this, studies into the quality of this literature for children are relatively few (Korat & Shamir, 2004; Yokota & Teale, 2014). Just as research has shown the importance of choosing quality printed children's literature for literacy development (Bang, 2000; Haugland & Wright, 1997; Sulzby, 1985; Sipe, 2008), researchers (e.g., Labbo & Kuhn, 2000; Yokota & Teale, 2014) consider the selection of quality e-books for children to be equally important.

Up to this point, much of the research conducted on quality was for electronic books (e-books, digital books) designed for use on desktop computers along with a mouse (Bus, Takacs, & Kegel, 2014; De Jong & Bus, 2002; Salmon, 2013; Smeets & Bus, 2013), and this technology is becoming increasingly outdated. In fact, research on e-books for use on desktop computers has demonstrated the importance of quality. For example, the interactive nature of certain electronic books (e.g., dictionary, text-to-speech highlighting, hotspots) has the potential to either support or distract young readers. However, little research has been conducted on e-books designed for mobile platforms (e.g., tablets and mobile devices), which offer increased access to multimodal (e.g., seeing, touching, hearing, shaking/moving, speaking) features. In fact, 95% of families with kids between zero and eight years old have access to smartphones (Rideout, 2017); they are using mobile devices[1] for a number of activities such as reading, listening to

[1] For the rest of this paper, the term mobile devices will include, but not be limited to,

music, entertainment, and playing games (Rideout, 2017). These mobile multimodal devices allow for interactions that were not available on desktop computers at the time the previously cited research was conducted. As such, an updated study on digital books (the current term used to describe all types of e-books) should reflect how technology has advanced from studies of e-books read on desktop computers using a mouse to the interactive mobile devices being used today. As reading conventions in the digital world change to reflect new technology, the ways readers negotiate meaning through interactive features also change (Knobel & Lankshear, 2014). More research focused on interactive features (e.g., touch, drag, or shake to activate an animation/text/link; music options; and games) found in digital books designed for mobile devices is critical, especially because the previous work was conducted with outdated technology (i.e., desktop computers and mouse). That is, we need to understand how current touch screen mobile technology changed the reading experience in order to someday better understand reading development in the digital age. To that end, more needs to be understood about the features readers encounter on these touchscreen mobile devices by way of a content features analysis in order to potentially gain insights into how children are reading digital books. The present study examined the unique features of purposefully selected high-quality digital books used on multimodal mobile devices (e.g., iPad or Kindle) that are based upon well-known stories in children's literature. It was limited to narrative texts and explored the multimodal interactive features of those selections.

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devices such as iPads, Amazon Kindle, iPhones, and Google phones.

Research Foundation

Few studies have evaluated or defined the *quality* of digital books as a potential means of supporting young children's reading development, and most of those that have used platforms such as CD-ROMs and desktop computers. Both are now obsolete in today's fast-paced mobile world (De Jong & Bus, 2003; Korat & Shamir, 2004). As researchers are beginning to examine digital books, consensus is developing around the understanding that the quality of the content and how interactive features (e.g., hotspots, games, media) interact with that content are key factors in these digital tools' ability to support literacy learning (Bus et al., 2014; De Jong & Bus, 2002; Korat & Shamir, 2004). In picture books, the term *high-quality* refers to well-designed picture books that elicit and engage children in making meaning through words, illustrations, and book designs (Lambert, 2015; Yokota, 2013). The components of what defines a high-quality picture book alongside interactive features present in digital books are what determines the quality of the story in a digital format.

One of the first e-book evaluations on digital book features and their impact on the quality of the book was conducted by Labbo and Kuhn (2000). They evaluated two CD-ROM storybooks that were replicated from well-known print picture books, *Stellaluna* (Cannon, 1996) and *Arthur's Teacher Trouble* (Brown, 1994). Labbo and Kuhn's content analysis (2000) was informed by Mandler and Johnson's (1977) notion of story structure (e.g. setting, problem, characters, resolution) and Armbruster and Anderson's (1984) constructs of considerate or inconsiderate texts. Considerate texts are written in ways that support students' comprehension, as opposed to inconsiderate texts.

This can be seen in regard to structure, audience appropriateness, coherence, and unity. Within the considerate and inconsiderate constructs, the terms integral (vital or corresponding actions), incidental (additional or plausible actions), and incongruent (disparate and illogical actions) describe whether the features were supportive in meaning-making (Labbo & Kuhn, 2000). The framework was initially designed to evaluate content area and text structure to determine if they were supportive or nonsupportive of comprehension. Labbo and Kuhn's study adapted the Armbruster and Anderson's (1984) considerate and inconsiderate framework to apply it to whether e-book features would assist young children in "following or remembering the story" (Labbo & Kuhn, 2000, p. 191). Because teachers select and mediate the story for young children, the concept of considerate texts allows for a better understanding in the role of the text and how children make meaning. However, since children can interact with digital books independently, whether or not these texts are considerate or inconsiderate takes on greater importance, even for the youngest school-aged learners. This framework allowed the researchers to characterize aspects of the digital books by utilizing the structures found within traditional texts; as such, they "considered anything that was related to the story structure to be considerate and anything that was not related to the story structure to be inconsiderate" (Labbo & Kuhn, 2000, p. 192).

Labbo and Kuhn (2000) adapted the terms considerate and inconsiderate (Armbruster & Anderson, 1984) to indicate the quality of both the content and the interactive features available on current commercial digital books and how these texts potentially support reading development. For example, Labbo and Kuhn found 84% (*n* =

201) of the multimedia effects in the electronic version of *Stellaluna* were considered to be either integral or incidental; as such, they designated this e-book a considerate text. In contrast, only 44% (n = 165) of the multimedia features in *Arthur's Teacher Trouble* were either integral or incidental; therefore, they classified it as an inconsiderate text..

This classification seemed to be confirmed by the retelling of one of their focus students, Roberto, who engaged in "rich chains of affect and cognition when reading *Stellaluna*, but … in nonconnected and passive attentive behaviors when interacting with the story-incongruent multimedia features of *Arthur's Teacher Trouble*" (Labbo & Kuhn, 2000, p. 201).

Labbo and Kuhn's (2000) findings substantiated their claim that when the story incorporated a high percentage of incongruent features, Roberto's retelling did not connect to the story grammar. When Roberto was presented with a high percentage of integral features, such as those found in *Stellaluna*, on the other hand, he was able to make meaning that paralleled the narrative structure. The authors argue that, as a kindergartener, Roberto was developing his sense of story structure (a critical component of school literacy) and that only the considerate text aided this type of reading development. Because researchers continue to turn to these findings, an updated evaluation of this approach to determine if they are applicable to currently available digital books and their interactive features would serve to inform the field, especially if we are to understand how these features may impact reading development.

Theoretical Framework

The present study was framed with an overarching theoretical question: How do the affordances of digital books change the nature of reading? In order to better understand the potential impact of digital books, we must first understand the role of technology's effect on literacy and how it has transformed literacy today. *Literacy*, as defined by Knobel and Lankshear (2007), is the act of reading, writing, decoding, and encoding print to create meaning for understanding. The term literacy shifted to include advances in technology. One way to describe this shift is through the terminology *new literacies* (Knobel & Lankshear, 2014):

> As social practices mediated by digital technologies, new literacies differ fundamentally from conventional print literacies on the basis that their inscriptions are rendered in pixels on screens rather than by impressions on paper, by means of digital code rather than material analogue means (whether printed and illustrated/imaged/diagrammed by hand, typewriter, or press). (p. 98)

Knobel and Lankshear (2014) indicate such changes can be seen in multiple ways, including the presentation of text on pixelated, encoded screens that allows for multimodal experiences (e.g., seeing, touching, hearing, shaking/moving, speaking). This process of reading and engaging with a story on a screen is unlike the traditional ink and paper impression. As reading conventions in the digital world alter in response to the technological advancement, how the reader negotiates meaning may also change. These changes can be seen through inclusion of interactive features (e.g., dictionary, text-to-speech highlighting, hotspots) and hypertext (e.g., nonlinear digital text that allows

readers to explore one interactive segment to the next) (Reinking, 1997). The new literacies theoretical lens that underpins this research has the potential to address how digital books have changed reading with their interactive multimodal features on mobile devices.

Background: Initial Pilot Study

Given our understanding of the importance of quality children's books (Bang, 2000; Sipe, 2008; Sulzby, 1985), I felt it important to explore the framework presented by Labbo and Kuhn (2000) with the most recent iteration of digital books read on mobile devices. As part of this process, I conducted a pilot study (Ly, 2016) investigating whether features in multimodal digital books read on mobile devices (i.e., iPad) would support meaning making for young children according to these guidelines. I conducted a content feature analysis of four purposefully selected texts to determine whether they could be classified as considerate and inconsiderate (Armbruster & Anderson, 1984). Of the four popular digital books titles I explored, two of the four books, *Curious George and the Firefighters* (84% integral and 16% incidental; Tribal Nova, 2014) and *The Going to Bed Book* (27% integral and 55 % incidental; Loud Crow Interactive, 2011), were designated considerate, whereas two others, *Little Red Riding Hood* (28% congruent and 24% incidental; Nosy Crow, 2013) and *The Three Little Pigs* (4% congruent with 6 % incidental; Tabtale, 2014), were designated inconsiderate. This present study added to the growing research indicating that the quality of content and features matters in multimodal digital books as well as in printed books. As such, my aim was to continue this line of inquiry to determine whether or not high-quality digital books with their

multimodal interactive features support the narrative in the story.

Purpose of the Proposed Study

This study aimed to update and extend Labbo and Kuhn's (2000) research by analyzing and evaluating the quality of currently available commercial digital books on multimodal devices (i.e., iPad). The titles were selected purposefully and were electronic versions of high-quality children's books that are often found in preschool through second grade classrooms. The selections were also compatible with mobile platforms and devices (Apple or Android). The content feature analysis contributed to the overarching theoretical question: How have digital books affected the nature of reading? In particular, the present study focused on how text that integrates interactive features on mobile platforms may affect the story narrative and how these features support comprehension. This broad question guided the study's more specific questions:

1. What are the types of interactive features found in e-book versions (digital books) of high-quality printed books that are currently available on mobile devices?
2. What interactive features from the considerate/inconsiderate framework (i.e., integral, incidental, and incongruent) are still effective for e-book classification, and do these terms need to be modified for current digital books?
3. How can the findings from the content feature analysis inform the development of an evaluative tool that helps teachers decide whether an e-book would readily support students' understanding of story grammar?

The answers to these questions contribute to our current understanding of the features present in the types of digital books that are being used in classrooms and libraries across the country. Additionally, the study informs the field about the interactive features found in digital books, which may serve to better understand how reading development has changed.

A selection criteria process was followed to identify available high-quality e-book versions of printed children's books. This method determined the quantity of texts currently available on the market that are both high-quality versions of printed children's books and offered in digital form. A content feature analysis was conducted on the number of digital books available for commercial purchase. Examining high-quality print versions of children's books in digital form allowed me to identify and gain insights into the types of interactive features and thus determine whether the framework Labbo and Kuhn (2000) identified is still valid as a means of identifying considerate and inconsiderate texts.

Significance

Currently, research conducted by Chera and Wood (Chera & Wood, 2003; Wood 2005), Korat and Shamir (2007, 2008, 2012), and Segal-Drori, Korat, Shamir, and Klein (2010) indicates that when digital books designed for use on desktop computers, which are antiquated technology, are developed with the guidance of a literacy researcher, they can be used to support literacy learning. Research on commercial versions of these books, on the other hand, has produced mixed findings. However, no research has conducted a content analysis on multimodal mobile digital books with their interactive features. In

fact, the last content analysis of digital books on any platform was conducted more than ten years ago (Labbo & Kuhn, 2000; De Jong & Bus, 2002; Korat & Shamir, 2004). At that time, digital books were read on desktop computers using a mouse, whereas current digital books are being read on mobile devices that allow for a touchscreen multimodal experience. As technology advances, it is imperative that research reflects currently available features; in the case of digital books, this means looking at texts that are read on different platforms (e.g., mobile phones, tablets) and offer multimodal features (e.g., seeing, touching, hearing, shaking/moving, speaking). Critically, this includes looking at how these interactive features can be characterized as supporting the development of story structure, especially for young learners (Labbo & Kuhn, 2000).

It is the case that digital tools, such as digital books, are being read both in and out of classrooms. Yet, a lack of understanding of what makes a text considerate or inconsiderate for young readers makes it difficult to select digital books that may contribute to their reading development. It is important to identify the types of interactive features that contribute to supporting reading comprehension in an e-book. As such, the content feature analysis served to further understanding of how these features aid in supporting high-quality digital texts. Being able to identify these features assists the selection process. This study's content feature analysis provides support to teachers and parents in determining whether a given e-book is considerate or inconsiderate and, therefore, worthy of purchasing. The answers to the research questions posed in my study provide valuable insights into the interactive multimodal features of digital books read on mobile devices and how these features may or may not support meaning-making for

young children (Labbo & Kuhn, 2000). Exploring each of the questions identified above will add to the limited research on the types of content and unique interactive features read on multimodal mobile devices that are being offered in digital books currently available to the public. Lastly, in order to someday address the ways features affect reading development, more needs to be understood about the features found in digital books, and my study will add to that body of knowledge.

Definition of Terms

Book apps appear as icons on mobile devices (e.g., phones, tablets) and are used to describe digital books (Bacon, 2013).

Considerate texts use structure and content to support students' comprehension; if a text uses structure (i.e., is the text structure suited for the content?), coherence (i.e., does it make sense the way it is written?), audience appropriateness (i.e., will the targeted audience understand the text and concepts?), and unity (i.e., is the text is written with one focus and is not distracting?), it supports comprehension (Labbo & Kuhn, 2000).

Comprehension is defined as a dynamic process that occurs simultaneously between the reader (person actively trying to make meaning), text (object that requires meaning making), and activity (purpose for reading) (RAND Reading Study Group, 2002). We read to create meaning for understanding (Knobel & Lankshear, 2014).

Digital affordances are actionable possibilities created by the digital environment (Gibson, 1977), that are unavailable through traditional texts and include text-speech highlighting, read-to-me and read-to-self options, and various music and sound effects (Yokota & Teale, 2014).

Digital divide is the widening gap of access to digital devices and Internet between the underprivileged poor to the middle class and wealthy Americans.

Electronic books (basic e-books) are digital objects with text and content that may integrate printed book features (Vassiliou & Rowley, 2008) and can be read on any device, or e-reader, such as a Kindle or Amazon Nook, and those options that are available are minimal (e.g., the ability to annotate, highlight, access a dictionary, or change font size).

Enhanced e-books are electronic books that offer the ability to alter text (e.g. highlighting or changing text), text-speech highlighting features, basic visuals (e.g., static illustrations), sound, music, and access to hotspots, or animation activated by touch or the use of a mouse (Bacon, 2013).

Hotspots are either animations or text or links to a text file or document in a different location. These can be activated when a reader clicks on them either with a mouse or by touch (Larson, 2009).

Inconsiderate text is a text in which elements such as structure, coherence, audience appropriateness, and unity are missing or fail to support comprehension (Labbo & Kuhn, 2000).

Interactive digital books (IDB) have features such as read-to-me, read-by-myself, and play-with-me modes, and they also have interactivity options (e.g., touch, drag, shake, etc.), animation, a variety of music options, games, and numerous (five or more) hotspots per screen (McKenna, Labbo, Conradi, & Baxter, 2011; Roskos & Burstein, 2012; Smeets & Bus, 2012).

New Literacies was introduced to account for the shift in reading that has resulted from the introduction of technology. As reading has changed to include current advances in technology, the forms that are on offer include being able to read with multimodal experiences (e.g., seeing, touching, hearing, shaking/moving, speaking) (Knobel & Lankshear, 2014).

CHAPTER TWO: LITERATURE REVIEW

Introduction

Researchers have long documented the importance of choosing quality printed literature for children's literacy development (Bang, 2000; Haugland & Wright, 1997; Sulzby, 1985; Sipe, 2007). E-books, on the other hand, have come to be widely used in schools (Sun, 2014) without a similar base of knowledge regarding the quality of e-books in general, and those designed for mobile devices in particular (Kucirkova, 2013). According to Korat and Shamir (2012), the quality of both the forms and features of an e-book can contribute to its suitability as a tool for literacy learning. Given that the quality of a digital text can determine whether or not it will support reading development, it is important to look at the multimodal features that occur in digital versions of popular printed picture books and whether they may assist or hinder young readers' meaning making (De Jong & Bus, 2002, 2003; Miller & Warschauer, 2014).

Over the past two decades, research on e-books conducted on desktop computers and a mouse had varied results. Some studies indicate that e-books do support literacy development for young children (Ciampa, 2015; Korat & Shamir, 2008, 2012; Roskos, Sullivan, Simpson, & Zuzolo, 2016), whereas others suggest they do not (Grimshaw, Dungworth, McKnight, & Morris, 2007; Jones & Brown, 2011; Trushell, Burrell, & Maitland, 2001). Often this divide can be seen in terms of the greater effectiveness of researcher-designed e-books (e.g., Ihmeideh, 2014; Korat & Shamir, 2008, 2012; Shamir & Shlafer, 2011) and the less effective commercially designed texts (e.g., De Jong & Bus, 2002, 2004; Grimshaw et al., 2007; Labbo & Kuhn, 2000; Trushell, et al., 2001;

Trushell & Maitland, 2005; Trushell, Maitland, & Burrell, 2003). In addition, there is limited research on the role of recent changes to the role of multimodal mobile devices and no research on the ways in which current commercial texts, or their interactive features, support reading development (Yokota & Teale, 2014). As form and features have changed over time, the type of platform we use has also shifted—from large desktop computers to more convenient mobile devices (e.g., phones, tablets, e-readers). The adaptation from stationary to mobile accommodates the fast pace of modern life (Yokota, 2013) but this change in technology may not have transitioned well as tools used for children's reading development (e.g., e-books on mobile devices) (Yokota, 2013; Yokota &Teale, 2014). These technological changes have impacted reading conventions (Knobel & Lankshear, 2014), and research on e-books should consider how the unique interactive features may affect meaning making for young children (De Jong & Bus, 2003; Korat & Shamir, 2004). Taken together, there is a need to expand on the research by evaluating e-books with today's unique touchscreen multimodal features read on mobile devices; this review has further focused on the quality of e-book versions of printed picture books.

Given that digital books have been around since the late 1990s (Larson, 2015), Yokota and Teale (2014) argue that they should not be viewed as a panacea for literacy learning, but as an alternative tool to support readers. In order to determine whether a digital book can support children's literacy learning, it is critical to determine the effectiveness of the interactive features found in digital books read on multimodal mobile devices. As of now, there is a paucity of research literature that explores the application of a content feature analysis on these texts (De Jong & Bus, 2003; Korat & Shamir, 2004;

Labbo & Kuhn, 2000), especially on current mobile devices. The current literature review examined research on the form and features of digital books in order to inform the need for and design of the present study. A study that examines interactive multimodal features on a mobile device has the potential to inform an evaluation tool to help teachers in selecting digital books to support meaning-making is important, especially when this technology is ubiquitous.

The focus of the literature review has been to examine research conducted applying a content analysis on digital books. In the sections that follow, began by reviewing the evolution of digital books; this knowledge contextualizes how digital books and printed picture books have influenced students' reading. I then focused on the theoretical lens that frames the literature review. Finally, I discussed those studies that have applied a content analysis method to digital books; this informs the direction of my examination into the unique interactive features found in today's digital books read on mobile devices.

What Is an E-book?

A Brief History of Digital Books.

It is important to understand the history of digital books and their changing form to contextualize their development. E-books were first introduced in the early 1990s and were essentially a scanned version of books in portable document format files (PDFs) on CD-ROMs (Buckleitner, 2011; De Jong & Bus, 2003; Guernsey & Levine, 2015; Paciga & Hoffman, 2015). Over time, iterations of e-books on CD-ROMs began to include animations, hotspots, and games. Although they are still sold today in limited numbers,

affordable mobile technology and the ease with which information can be shared and stored on the Internet have rendered them largely obsolete (Eaton, 2012).

In fact, e-books are currently accessible on a variety of platforms, including mobile devices such as touchscreen smartphones and tablets (e.g., iPads, Nook, Kindle) (Vassiliou & Rowley, 2008). These platforms interact with digital books in a variety of ways. For example, Kindles are handheld readers that provide access to books or content material. Readers can annotate and highlight books using these devices, and some digital books available on Kindle even offer text-to-speech features such as vocalization. These readers are also available as an app that can be downloaded onto other mobile devices and used to read digital books. In other words, if a reader has a given app and a corresponding account across different platforms, their device will sync with their reading materials so they can be read on any of these platforms (e.g., Kindle, iPhone, iPad). However, the content materials, such as digital books and features found on a given reader (e.g., Kindle, Nook) may not be the same as those on a tablet or other mobile device. For example, there are book apps that can be read on a tablet but not on an e-reader; alternatively, some digital books can be read on any device (although they may require an e-reader app, such as the Kindle app or iLibrary).

Depending on the format, book apps, unlike basic digital books, can also be interactive (Greenfield, 2012). Readers can interact with the text through *hotspots*; these can be either animation, text, or a link to a text file or document in a different location, which is on the cloud rather than on the hard drive. The cloud incorporates any services or software that run on the Internet and stores information remotely (e.g., Google Drive,

Dropbox, Microsoft OneDrive, Netflix). Hotspots in electronic texts can be activated when a reader clicks on them, either with a mouse or by touch (Larson, 2010). Further, since many digital books feature interactive media effects such as games, animation, and multi-touch stories, an additional layer of complexity may be present when compared to basic e-books such as a PDF.

An interactive media effect can be seen in the interactive digital book, *Little Red Riding Hood* (Nosy Crow, 2013). This book app includes games that are interwoven throughout the story and how you "defeat" the wolf is dependent upon how you respond to these games. For example, in one option, children blow into their platform's microphone, causing wind to be blown into the wolf's face. This type of multimodal interaction (i.e., blowing into a microphone) is not available in basic e-books, enhanced e-books, or printed picture books.

The Spectrum of E-books.

A number of researchers (e.g., De Jong & Bus, 2003; Guernsey, 2011; Korat & Shamir, 2004; Roskos, 2013) argue that the term e-book no longer adequately describes the range, quality, and variety of available texts. To clarify the spectrum of e-books currently available, I designed a classification system based upon their various forms and features (see Table 1). In order to identify studies for this classification system, I conducted a search using two educational databases, ERIC and Psych INFO. I identified three categories: basic e-books, enhanced e-books, and interactive digital books from the research studies that focused on e-books and literacy development both in and out of the classroom.

Due to the ever-changing landscape of e-books (Bircher, 2012), this classification system was designed to encapsulate the range of e-books currently available; however, it was intended to be flexible enough to incorporate future variation (Roskos, Burstein, You, Brueck, & O'Brien, 2011). I used the terms presented in Table 1 for the remainder of this discussion. Importantly, CD-ROM e-books fall into two categories in this classification system depending on their features; e-books in early studies were basic, whereas later research made use of enhanced e-books.

Basic e-books are formatted as scanned books, or PDFs of printed books (see Figure 1). Many basic e-books can be found on the Internet and are often free to download. Generally, a basic e-book can be read on a device, or e-reader, such as a Kindle or Amazon Nook and, if there is an option included, it will involve the ability to alter text in a minimal manner (e.g. annotate, highlight, change font size), but not move or adapt it otherwise.

Figure 1

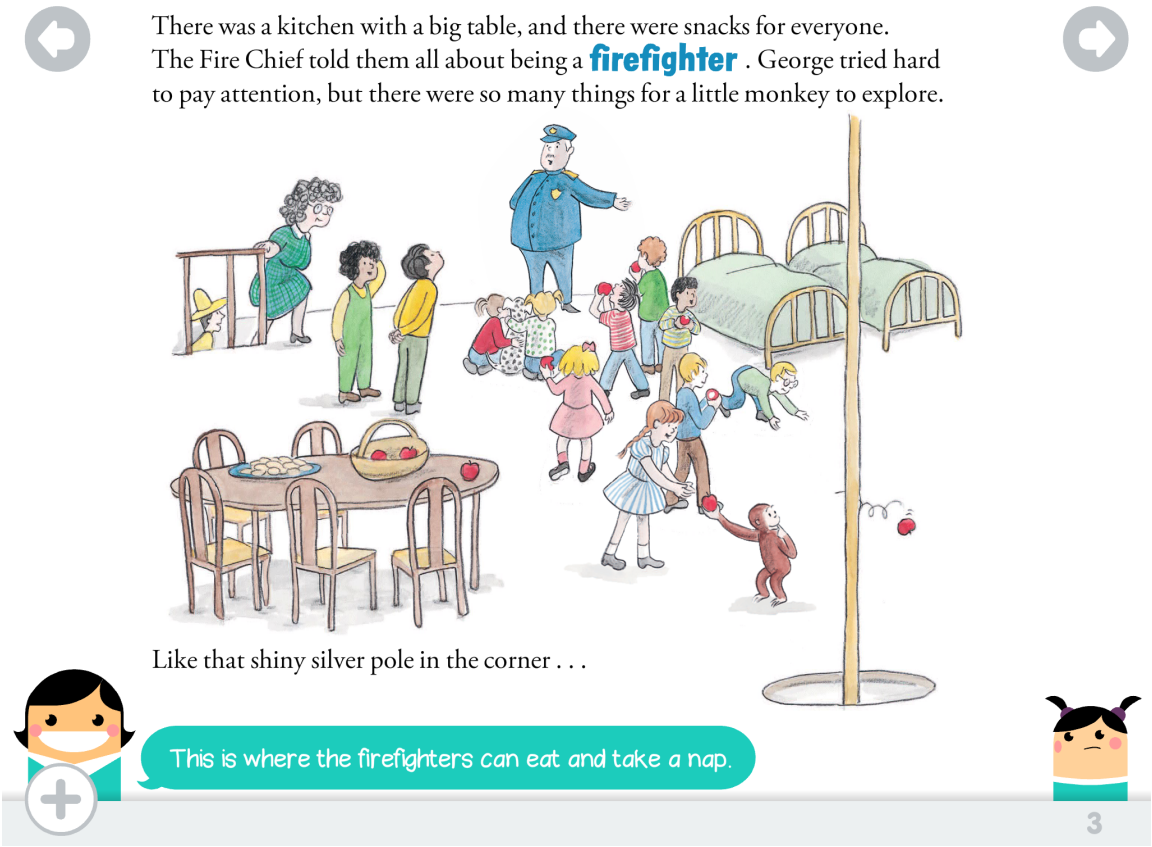
Screenshot of Basic E-book

Types	Shared features (all e-books)	Shared features (enhanced e-books and IDBs)	Unique features
Basic e-books (PDFs)	Ability to alter text (e.g., decrease and increase text size; annotate text), home screen/menu option		Scanned books, PDFs, books in digital form, may provide a text-to-speech feature read by a computer-generated voice
Enhanced e-books	Ability to alter text (e.g., decrease and increase text size; annotate text), home screen/menu option	Read to me, read by myself, music, sound effects, hotspots	Basic visuals (can be static illustrations), sounds
Interactive digital books (IDBs)	Ability to alter text (e.g., decrease and increase text size; annotate text), home screen/menu option	Read to me, read by myself, music, sound effects, hotspots	Play with me options, interactive (touch, zoom, drag, dialogue between character and reader), animation, games

Table 1. Types of E-books and Their Features

The second category is the enhanced e-books (see Figure 2). Enhanced e-books deliver access to touchscreen technology and, in addition to altering texts (e.g. highlight, change size of text), they include options such as text-to-speech, highlighting features, basic visuals, sound, music, and access to several hotspots per page. Enhanced e-books can be found as free or paid downloads on the Internet, on CD-ROMs, or as an app from the App store or Google Play.

Figure 2
Screenshot of Enhanced E-book



The third category, the interactive digital book (IDB) offers the highest level of interactivity between the user and the text (McKenna, Labbo, Conradi, & Baxter, 2011; Roskos & Burstein, 2012; Smeets & Bus, 2012) (see Figure 3). IDBs not only have features such as read to me, read by myself, and play with me modes but they also have interactivity options (e.g., touch, drag, shake, etc.), animation, a variety of music options, games, and numerous hotspots per screen. IDBs are normally purchased and will appear as an app icon on touchscreen smart devices, such as the iPad or Chromebook. In the context of my study, these terms were used to identify the types of digital books currently

available (See Table 1).

Figure 3
Screenshot of an Interactive Digital Book

Background on Picture Books.

The research around picture books is rich, with much evidence and research into how their text, illustrations, and design interact with each other (e.g., Bang, 2000; Nikolajeva & Scott, 2001) to play a significant role in children's literacy development (Yokota & Teale, 2014). As Sipe (1998) states in his analysis of the interaction between text and illustration,

> In a picture book, both the text and illustration sequence would be incomplete without the other. They have a synergistic relationship in which the total effect

> depends not only on the union of the text and illustration but also on the perceived interaction or transaction between these two parts. (Sipe, 1998, pp. 98–99)

Essentially, without the interplay that happens between the text and illustration, the story is incomplete. This interaction considers the *perceived* reader and their role in making meaning from both the text and illustrations, simultaneously processing the information to comprehend the event or action of the story.

While the literature has established that the illustration, text, book design, size, and shape of a picture book can play a significant role in the way a child experiences the story (Sipe, 2008; Sulzby & Teale, 1986; Yokota, 2013), how this may translate into the digital world has not been thoroughly explored (Yokota, 2013). According to Yokota (2013), Maurice Sendak's *Where the Wild Things Are* (1963) is a well-designed picture book; in this example, the book was intentionally created to provide a unique journey for the reader. By changing the format of this picture book from the printed version to a digital version, it is possible that the reader will be taken on a different journey than the author intended. However, as Yokota (2015) has argued, the debate surrounding e-books should not be a matter of determining which format is better but instead a matter of determining which allows children to utilize the form and format effectively. The method of storytelling has changed over the course of history, from oral to print to the recent addition of e-books (Yokota, 2015), and, at present, all three formats are capable of coexisting. Given this, determining how each of these formats can best be utilized may provide the most positive direction for assisting young children's comprehension development.

Theoretical Framework

This literature review has been framed with the overarching theoretical question: In what ways might the affordances found in digital books change the nature of reading comprehension? Although the present study examined how interactive features affect meaning making in a digital book, it does not offer an answer about reading comprehension. Rather, my study fills one important piece about the effects of interactive features found in a digital book that may potentially support reading comprehension. For a complete picture on how my study fits into the research on digital literacies, it is important to understand the role of reading comprehension and how technology has changed what it means to read in different forms and features. According to the RAND Reading Study Group (2002), reading comprehension is defined as a dynamic process that occurs simultaneously between the reader (person actively trying to make meaning), text (object that requires meaning making), and activity (purpose for reading). This definition considers text in their both print and electronic forms (RAND Reading Study Group, 2002). In other words, we read to create meaning for understanding (Knobel & Lankshear, 2014). As noted in chapter one, the term *new literacies* (Knobel & Lankshear, 2014) was introduced to account for the shift in reading that has resulted from the introduction of technology. As reading has changed to include current advances in technology, the forms that are on offer include being able to read with multimodal experiences (e.g., seeing, touching, hearing, shaking/moving, speaking). Given technology's ongoing evolution, our understanding of the nature of reading needs to be continually updated as well; to that end, we should be able to account for the different

forms and features of the reading process occurring while reading on digital books that offer multimodal interactive features. I have used the theoretical lens of new literacies to examine how the unique interactive multimodal features in e-books read on mobile devices have changed the reading experience by way of understanding how the features affect the story.

Research on the Use of E-books

Content Analysis Studies

In total, three studies met the selection criteria for this review; this indicates that only a small number of studies have evaluated digital books and their features regarding their potential to support young children's reading development. The first study that fell within my parameters was conducted by Labbo and Kuhn (2000). Labbo and Kuhn analyzed two CD-ROM talking books (e-books) based on research drawing upon the relationship between the way a book is presented and a student's comprehension of the text. According the constructs developed by Armbruster and Anderson (1984), texts that are supportive of their readers' comprehension (through their structure, coherence, audience appropriateness, and unity) are identified as "considerate" (p. 2); conversely, those that do not support comprehension through these structures are seen as "inconsiderate" (p. 2). Labbo and Kuhn analyzed two talking texts (the term used at the time), *Arthur's Teacher Trouble* (Brown, 1994) and *Stellaluna* (Cannon, 1996), using a modified version of Armbruster and Anderson's (1984) construct. Their findings revealed that the media effects in *Arthur's Teacher Trouble* were inconsiderate in comparison to *Stellaluna.* These findings were based on the percentages of media effects per screen that

disrupted the story structure: 56% (n = 214) of the interactions in *Arthur's Teacher Trouble* were disruptive as compared to 16% (n = 38) for *Stellaluna*.

Labbo and Kuhn's (2000) study operated in accordance with the new literacies theoretical framework in so far as the findings identified the way media effects change the reader's experience when compared to the reading of a traditional printed book. This change is evidenced by Roberto's (a case study) attention, engagement, and meaning making processes. When he was interacting with the inconsiderate text, *Arthur's Teacher Trouble*, he fell into a passive viewing state (Labbo & Kuhn, 2000). On the contrary, while he was interacting with *Stellaluna*, a considerate text, he was able to construct meaning through the media effects (e.g., wondering what the mother bat was doing, and asking "what is this?") (Labbo & Kuhn, 2000, p. 200). The authors further suggest that, when a large number of media effects are present and a picture book has been deemed inconsiderate, meaning making may result in a disconnected understanding of the story and its underlying structure.

Subsequently, De Jong and Bus (2003) undertook a content analysis examining a larger quantity of e-books. In this review, they analyzed 55 Dutch and five English e-books that were commercially available. They evaluated the text books using the following coding categories: book processing (e.g., introductory screen options), multimedia connected to pictures (e.g., dynamic visuals to dramatize the story), multimedia connected to print or spoken texts (e.g., availability of an oral reading), interactivity to the story (e.g., hotspots availability and integration into the story), interactive legibility (e.g., options to start, restart, and interrupt oral reading), and quality

of print and hotspots (e.g., congruence of story and hidden hotpots) (De Jong & Bus, 2003). De Jong and Bus's content analysis included a coding scheme similar to that of Labbo and Kuhn (2000); however, they rated congruence of features using a three-point scale beginning with a sad face for features that were mostly incongruent with the story to a happy face where most of the features were integral with the story (De Jong & Bus, 2003). Their analysis on the quality of features was not as comprehensive as Labbo and Kuhn's study (2000).

The researchers found substantial variability across e-books, including a lack of homogeneity in formats and quality; they further noted that few of the multimedia or interactive features served as supports for literacy learning (De Jong & Bus, 2003; Korat & Shamir, 2004; Vaala, Ly, & Levine, 2015). Additionally, they noted that, under the category of book processing, 85.5% of the e-books had a narrator or character to explain how to navigate through the story, although less than half (47.3%) did not provide an overview option (De Jong & Bus, 2003). However, under the categories of multimedia in pictures and connected to print or spoken text, 72.2 % included dynamic visuals to support inferences about the story. Of the 60 e-books, 81.8% of the e-books (49 books) analyzed had companion books; further, 84.4% (51) of these had altered the text itself in some way (e.g., there were changes in colors or size, or entire lines were marked after they were read). In terms of the interactivity and interactive legibility categories, a read-only option was available in 30.9% of the e-books analyzed, whereas 92.7% offered games, puzzles, or tasks.

Next, 60% of the e-books incorporated hotspots that were hidden within the

illustrations as a means of motivating or engaging the reader; however, only 52.7% of these hotspots were integrated into the story. According to the researchers, a majority of the hotspots (90.6%) were incongruent, or distracting, whereas only 9.4% of the hotspots were congruent. Lastly, the majority of the e-books allowed children to restart (76.4%) or interrupt (78.2%) their reading. De Jong and Bus (2003) concluded that not many high-quality e-books were available on the market at that time. Their findings indicate that, as technology changes, it is critical to examine the forms and features that have changed as well. To that end, it is important to control high-quality texts in order to identify which features would support, distract, or hinder reading comprehension. De Jong and Bus (2003) undertook their study more than ten years ago based on outdated technology. An updated content analysis conducted on English language books read on mobile devices that offer current multimodal interactive features will inform research on the types of digital books existing on the market. Additionally, providing a comprehensive content feature analysis offers insights to each feature and how each individual feature relates to the story.

Following De Jong and Bus's (2003) study, Korat and Shamir (2004) replicated their study in order to determine whether De Jong and Bus's findings were generalizable to Hebrew e-books. While Korat and Shamir kept De Jong and Bus's (2003) content analysis coding categories, they included extra options involving print; these included screen titles, signs found in the illustration, markings that are particular to the Hebrew language, and printing text on paper (the option to print) (Korat & Shamir, 2004). Their findings echoed those found in De Jong and Bus's (2003) study. Korat and Shamir found

that 72% of the e-books analyzed offered an introductory screen, but only 25% offered an overview screen. Many of the e-books (82%) included dynamic visuals, yet only 28% included the option to alter the text. Most of the e-books (72%) included games and songs, but only 28% were integrated into the story, and hidden hotspots were only available on 28% of the selections. The researchers examined hotspots on 55 distinct screens from 12 texts; of these the researchers found they were usually congruent with the storyline. Similarly, Korat and Shamir's (2004) study was conducted over ten years ago on technology that is no longer in use in today's schools. As Korat and Shamir's study (2004) explored whether De Jong and Bus's study was generalizable to Hebrew e-books, findings from both of the studies may not be generalizable to e-books written in English. An up-to-date study would offer a fresh perspective on the types of digital book versions of high-quality printed texts that can potentially be used to support reading comprehension.

Overall, Korat and Shamir (2004) argue that Dutch and Hebrew e-books shared similar designs and that, in both cases, they were unsatisfactory. On the positive side, while there were not many hidden hotspots in the Hebrew e-books, those that were included were primarily congruent with the storyline. Ultimately, the authors agree with De Jong and Bus's (2003) conclusion that e-book developers should take care to produce texts with features that support the reader's understanding, especially as form and format will continue to change alongside advancing technology.

Taken together, these studies indicate the value of applying a content feature analysis method to current iterations of digital books to determine quality because it

could be the case that the interactive features could support children's reading development. Their findings support the assumption that the considerate/inconsiderate framework (Armbruster & Anderson, 1984) can characterize aspects of the digital books in a manner similar to that used with printed texts. Although it has been over a decade since a content analysis has been conducted on digital books, these studies indicate that additional work undertaken with the new generation of digital books can do two things: first, update researchers on the type of digital books features that may support, distract, or hinder story grammar, and second, expand on our ability to potentially inform an evaluation tool to help teachers select high-quality digital books that will support learners' reading development.

Conclusion

Digital books have been the subject of continuous study over the last 20 years, yet the majority of this work does not consider the availability of portable, affordable, and interactive devices and their integration into classrooms throughout the country. Although the field has been informed by the insight provided by the research on features found in enhanced e-books (e.g., De Jong & Bus, 2004; Grimshaw et al., 2007; Jones & Brown, 2011), there remains a gap in the literature in terms of authentic digital texts read online or as apps with multimodal capabilities. This is especially true in relation to mobile devices (e.g., iPad, Chromebook, Kindle Fire, Nook, and smartphones).

The present study has operated under the assumption that Armbruster and Anderson's (1984) framework of considerate (texts written in ways that support students' comprehension) and inconsiderate texts (texts hat fail to support student's

comprehension) can be used to characterize digital books on mobile devices. The purpose of this study was to investigate whether story structures found within high-quality printed texts are present in their digital counterparts (Mandler & Johnson, 1977). It also looked at the unique role of interactive features in supporting or distracting from that structure. A content feature analysis study on interactive features is critical because, as technology changes, how these features potentially affect the reading experience will impact how children make meaning of the digital stories. My study not only updates the field on the types of interactive features found in digital books but has the potential to inform future research on reading comprehension using digital books. In order for future research to reflect ongoing changes with technology, we must first understand how interactive features impact the story.

This literature review highlighted research findings from studies that applied a content analysis to digital books. As evidenced by this review, the research on the role of unique interactive features of e-books, especially on current digital books made for portable devices, is extremely limited. I have provided a context for the research questions answered in my study. These questions demonstrate how my investigation has built upon previous work in this field and contributed to our growing body of knowledge on digital books to inform how these features affect meaning making in a story.

CHAPTER THREE: METHODOLOGY

Sample

The aim of this empirical study was to confirm the validity of the considerate/inconsiderate framework designed by Labbo and Kuhn (2000) and, possibly, to expand upon it by paying particular attention to the new capabilities offered by mobile devices. This involved analyzing commercially available digital books based upon their unique interactive features. To do so, I conducted a descriptive, observational, content feature analysis of purposefully selected texts. I chose high-quality digital texts designated for three- to seven-year-olds in order to build upon previous research.

Book Selection Criteria

To determine which digital books to analyze, I identified children's e-book versions of high-quality printed texts. Because the original research using the considerate/inconsiderate framework (Labbo & Kuhn, 2000) used picture books formatted as CD-ROMs, it was important to see if the analysis continues to hold true with the current generation of digital book adaptations of quality picture books read on mobile devices. In order to select high-quality digital book versions of printed texts, I began by identifying current online app publishing companies. By focusing on app publishing companies, I excluded individual one-off app publishers (i.e., independent developers that create one app) and those who may not have any background experience in producing quality digital books. Next, I reviewed the Pre-K to 3rd grade e-book list published by each app company. Then, I looked for the print availability for each title on the Pre-K to 3rd grade list because my study was focused on digital books for three- to

eight-year-olds. I then cross-referenced the titles from the app company's list to *The Horn Book Guide Online* reviews. *The Horn Book Guide Online* review was chosen to determine quality of texts due to its consistent and rigorous reviews of children's books since 1924. Their reviewers, all of whom have a background in children's literature, adhere to strict guidelines. Any picture book titles that were rated 3 (recommended, satisfactory in style, content, and/or illustration) and above (1 being the highest ratings—outstanding, noteworthy in style, content, and/or illustration) (Horn Book Guide Online, 2018) were selected for the study. Once I had selected the digital versions of high-quality children's picture books, I purchased them and conducted a cursory examination to determine their range of features (e.g., low to high interactivity, initial count of hotspots per page, access to options such as games, and page turning options; see Table 2). I also looked at whether the texts offer reading options through the settings tab on the introductory page. Such options included the ability to turn certain features, such as music, on or off or to decide the length of time that the text appears on the screen. They also included the ability to activate or deactivate options such as read, read and talk, read and play a game, or play a game. Table 2 presents an array of features that were found in my pilot study (Ly, 2016), many of which were likely to be found in the digital books selected for this research. Because electronic texts without a range of features would be the equivalent of a PDF, any such text would be unsuitable for analysis. However, as long as such features are available, the exact number of features was not used to determine whether or not a digital book is excluded from the study.

Array of features	*Little Red Riding Hood*	*The Three Little Pigs*	*The Going to Bed Book*	*Curious George and the Firefighters*
Interactive elements	×	×	×	×
Animated screen	×	×		
Passive screen				×
Different home screen options (e.g., read, read-to-me, play-with-me, listen)	×	×	×	×
Options for setting	×			×
Home button option on every screen	×	×		×
Options to change language				×
Options to turn on/off interactivity				×
Options to turn on/off music		×		×
Option for length of time for text to appear	×			
Option for reading levels				×
Options for games (embedded or on home screen)	×	×		
Text-speech highlighting		×	×	
Option to turn on text-speech highlighting	×			
Option to touch a word and have the word reread			×	

Table 2. Array of Features

Data Analysis Procedures

I compared the structures found within traditional texts to those in the selected electronic texts by using Mandler and Johnson's framework (1977). This allowed me to focus on story structure (e.g. setting, problem, characters, resolution) as a means of supporting comprehension; I conducted this analysis both without and with the electronic features options to compare both options to the book version of the texts.

Next, I evaluated electronic text features within the books using the constructs of considerate (anything related to the story structure) or inconsiderate (anything unrelated to the story structure) texts developed by Armbruster and Anderson (1984). To implement this process, I coded the features on each screen for (a) their role in the story structure and (b) the inclusion of animation. The coding table for each story consisted of five components: title, type of screen (e.g., animated interactive screen), screen features (i.e., music, sound effects, highlighted text, animated illustration, and games), story relationship (i.e., integral, incidental, or inconsiderate), and story structure (setting, goal, resolution, and additional explanations). Additionally, I assigned a number to each screen in the story. Numbering each screen delineated the sequencing of the digital book, especially if the screen was static or animated.

My methodology has been informed by my pilot study (Ly, 2016) during which I analyzed four digital books following the procedure developed by Labbo and Kuhn (2000). In that study, my findings suggested that screens fall into one of four types: (a) animated interactive, or screens in which readers can interact with animation *after* it completes an automatic action; (b) interactive, in which readers can interact with hotspots

by touching an object or moving a character at any time; (c) passive interactive, in which screens replicate a printed text with the addition of one or two hotspots that allow for interaction; or (d) passive, in which a screen parallels a printed text. Any aspect of a screen that can be activated has been described, and coded, in column four (see Table 3). If an object incorporates an action that was repetitious, it was also noted, as were multiple actions on a given screen. Each action was coded with the screen number and a unique lowercase letter (e.g.,1a, 1b, 1c, etc.). If an animation incorporates dialogue, that scene was coded as one action.

Title	Type of Screen	Page/Screen	Screen Features	Story Relationship	Story Structure
Little Red Riding Hood	AIS	2-1 Animated conversation between two characters	The scene begins with a close up of LRRH and her mom. Mom: "Oh, Little Red Riding Hood, your grandma isn't feeling very well. Please would you take her a basket of food?" [After this statement, the scene expands to include the kitchen]	Integral	Setting – LRRH's house Event – tasked to go to Grandma's house
	AIS	2-2 Animated scene a conversation between two characters.	[No interaction on the part of the reader; characters continue to speak; all the comments are then repeated unless an action is taken.] LRRH : "Don't forget the cake?" Mom (to the audience): "Can you help LRRH pack the basket?" [this is the only thing LRRH's mom says in this interaction.] If there is no response from the reader, LRRH will say	Incidental	Setting – LRRH's house Event – packing basket for grandma

	the following in the following order: - “Let’s pack some apples.” - “Let’s give her some apples!” - “Let’s fill up this basket with lovely things for grandma.” - “Shall I take some cheese?”

Table 3. Example of Coding Sheet taken from Pilot Study

Labbo and Kuhn’s (2000) coding scheme also considers multiple interactions with one object on the same animated screen to be a single action. For example, in the digital book *Little Red Riding Hood* (Nosy Crow, 2013), Little Red Riding Hood is speaking in one scene, and during this period, the reader is unable to interrupt the character’s dialogue and prompt her for a different action. However, the reader is able to press the next button to interrupt the narration and move on to the next page. The coding of each action and animation has allowed me to identify the range available to the reader on every screen of the text.

Finally, I implemented constant comparative analysis to the screen features to derive the categories in the story relationship (column five; Glaser & Strauss, 1967; See Table 3).

Three categories—integral, incidental, or incongruent—were used to describe each interaction and its relation to the story structure. If the interactive feature contributes to or highlights an important part of the story, then it was identified as integral (Labbo & Kuhn, 2000). If the feature serves as an embellishment within the story, it was classified as incidental. And if the interactive feature fails to connect to the story in any logical

way, it was labeled as incongruent. When features were coded as integral or incidental, the element of the story structure that they connect to (e.g., setting, characters, events, or theme) was identified as considerate (Mandler & Johnson, 1977). If it was identified as incongruent, the element was labeled inconsiderate.

The coding that I have undertaken indicates how the features in digital books contribute to the quality of the stories and the story structure. The first step involved determining the percentages of integral, incidental, or incongruent features for each story. These percentages were then used to designate the digital books as either considerate (i.e., supportive of learners' comprehension) or inconsiderate (Labbo & Kuhn, 2000). Labbo and Kuhn's study based their designation on those constructs that showed clear relationships between the media effects available in a text and the story itself. After completing their analysis, *Stellaluna* was determined to be considerate (number of media effects = 201; 84% were incidental or integral, 16% were incongruent); *Arthur's Teacher's Trouble*, on the other hand, was classified as an inconsiderate text (number of media effects = 214; 44% were incidental or integral, 56% were incongruent).

Based on Labbo and Kuhn's (2000) norms, I chose to keep 70% as the cutoff point for determining whether a text should be designated as considerate or inconsiderate. They argued that if the reader is faced with incongruent features over half the time, she or he will have to expend more energy negotiating the construction of meaning and will be less likely to do so successfully. This is particularly true for younger learners who are still developing their sense of story structure. In order to make meaning, a reader needs the text to support rather than disrupt their developing understanding; when the majority of

features are integral and incidental, they better contribute to the reader's comprehension. When 70% or more of the animated features support a cohesive understanding of the reader's comprehension (e.g., integral or incidental), the text has been categorized as considerate, whereas if the animated features were predominately distracting, the text has been classified as inconsiderate.

To determine inter-rater reliability, I have identified a second person with a literacy background to code the texts. We independently coded the first five screens of each digital book and randomly selected two digital books to determine whether the texts were considerate or inconsiderate based on the content feature analysis. A rating reaching an 80% agreement or higher was considered acceptable based on the accordance of previous content analysis (e.g., Hoffman, Wilson, Martínez, & Sailors, 2011; Labbo & Kuhn, 2000). When an agreement level of at least 80% was not reached, all features that were disagreed upon have been discussed to find an agreed upon understanding of our coding.

The last component of my content feature analysis involved looking at individual media effects (Labbo & Kuhn, 2000), including interactive media animation. Because these multimedia effects are interconnected with the animation, the unit of analysis has been changed from an individual media effect to an interactive media effect. This provides a unit of analysis equivalent to the static screen in Labbo and Kuhn's study. It is important to note that viewing interactive animation as a single effect allows for a more accurate analysis of the digital book's components. By identifying each interactive media effect as a unit, I was able to accurately describe any potential enhancements of the

digital book and their effect on the story relationship; in other words, this highlighted the way that one interactive media effect can change the outcome of a story. An example of this can be found in Nosy Crow's *Little Red Riding Hood* (2013). In this particular version, Little Red has three paths she can choose from, each path arms her with different types of tools that will later be used to defeat the wolf, and the remainder of the story's narrative is dependent upon the path chosen. This adjustment demonstrates the need to evaluate changes in digital book features to account for potential enhancements over time.

Significance

Digital media such as digital books will continue to play an increasing role in children's lives (Guernsey & Levine, 2015). It is critical to examine multimodal features in digital books in order to possibly inform an evaluation tool to select digital books that support meaning-making. As librarians and teachers purchase digital books, an evaluation tool can become helpful in aiding them to identify considerate and inconsiderate texts and could assist them in determining which digital books would be better suited for students and their reading development. The findings from my study may inform an evaluation tool that can support teachers and librarians in selecting digital books for classroom use.

CHAPTER FOUR: FINDINGS

This chapter reports on the findings of high-quality digital book versions of printed texts that were selected using *The Horn Book Guide Online* review as a guide for high-quality picture books. In particular, this chapter responds to the following two research questions:

1. What are the types of interactive features found in e-book versions (digital books) of high-quality printed books that are currently available on mobile devices?
2. What interactive features from the considerate/inconsiderate framework (i.e., integral, incidental, and incongruent) are still effective for e-book classification, and do these terms need to be modified for current digital books?

By responding to these research questions, the findings may contribute to the conversation around the broader question: How have digital books affected the nature of reading? The following sections will explore the types of digital books that were deemed high-quality, the interactive media effects found within each digital book, and how these interactive features from the considerate/inconsiderate framework (i.e., integral incidental, and incongruent) are still effective in classifying high-quality digital books.

Overview of Findings

The analysis of high-quality digital book versions of printed texts, conducted using the read to me option, indicated there two were common book app publishers that dominated the high-quality list. The two publishers were Oceanhouse Media and Loud

Crow Interactive. Between these two publishing companies, Oceanhouse Media made up 90% (n = 20; 18 out of 20) of the high-quality digital book list. Within the texts that were selected, the analysis of the interactive media effects indicated differences in the types of interactivity within series and book app publishing companies. These interactive media features ranged from ones with embedded games and numerous hotspots (i.e., *Goodnight Moon;* Loud Crow Interactive, 2017) to simple animation with a number of hotspots focused mainly on vocabulary (i.e., Byron Barton's series, Oceanhouse Media, 2012) to static stories with hotspots focused on providing vocabulary to objects on the screen (i.e., *Tacky the Emperor* series, Oceanhouse Media, 2010, 2011; *Five Little Monkeys* series, Oceanhouse Media, 2011, 2012).

The analysis found the design of the books to be dependent on the digital book app publishing company. A unique feature was identified as one interactive media effect. The way the features related to the story had no connection to the number of unique features (see Table 4). For example, *Tacky and the Winter Games* (Oceanhouse Media, 2011) had the largest number of unique features at 427, whereas *Barnyard Dance!* (Loud Crow Interactive, 2017) had only 80 unique features, a substantial range between the two digital books.

Title	Integral	Incidental	Incongruent	Total unique features
Goodnight Moon	55	121	61	237
Barnyard Dance!	60	14	6	80
Goodnight, Goodnight Construction Site	209	0	0	209
Steam Train, Dream Train	263	1	0	264
Elmer and the Lost Teddy	129	0	0	129
How I Became a Pirate	202	0	0	202
Boats	109	28	0	137
Trains	112	21	0	133
Planes	94	30	0	124
Trucks	135	19	0	154
Tacky the Penguin	276	0	0	276
Tacky and the Winter Games	427	0	0	427
Tacky and the Emperor	356	0	0	356
Tacky Goes to Camp	351	0	0	351
Tacky's Christmas	350	0	0	350
Five Little Monkeys Jumping on the Bed	249	0	0	249
Five Little Monkeys Go Shopping	215	0	0	215
Five Little Monkeys Play Hide and Seek	210	0	0	210
Five Little Monkeys With Nothing to Do	297	0	0	297
Five Little Monkeys Wash the Car	306	0	0	306

Table 4. Total Number of Interactive Features Coded for Meaning-Making in Story

The classification of the 20 books was determined by the way their interactive media effects relate to the story and aid or inhibit the reader's understanding of the story. This process involves looking primarily at the role of the integral, incidental, and incongruent features during the read to me reading option. Using this classification scheme, all of the features found in digital books published by Oceanhouse Media were integral or incidental (see Table 4); as a result, these features actively support

comprehension and are congruent. Similarly, the two digital books from Loud Crow Interactive were deemed to have over 70% integral or incidental features and were identified as congruent. However, the number of incongruent features in *Goodnight Moon* with 26% and *Barnyard Dance!* with 8% illustrates that these texts offered interactive media effects that were disruptive to meaning making in the story. When parsing out the effects between integral and incidental, *Goodnight Moon* was found to have a large percentage of features that were classified as incidental.

Although the digital books that were analyzed were all classified as considerate, there were differences between the two book app publishing companies in the types of unique features that were offered and whether or not the interactive features supported or disrupted meaning making for young children.

The following sections will explore the interactive features found in high-quality digital books, re-examine the considerate and inconsiderate framework with current digital books, and determine whether and how the findings from the study inform an evaluative tool for teachers in selecting digital books.

Content Feature Analysis

First, I will discuss how I selected high-quality digital books. To provide additional information, I will present the range of reading options that are present on the introductory screens of all the e-books and the variety of additional options (for the reader/teacher/parent to turn on/off). Lastly, I will present the result of the content feature analysis to answer the first research question ("What are the types of interactive features found in e-book versions (digital books) of high-quality printed books that are currently

available on mobile devices?").

The list of digital books from Oceanhouse Media is organized as follows, first by series, and then by individual titles. The series of books were: Tacky the Penguin (Oceanhouse Media, 2010, 2011), Five Little Monkeys (Oceanhouse Media, 2011, 2012), and the Byron Barton Collection (*Planes*, *Trains*, *Trucks*, and *Boats*) (Oceanhouse Media, 2012). The individual titles are *Steam Train, Dream Train* (Oceanhouse Media, 2014); *How I Became a Pirate* (Oceanhouse Media, 2014); *Goodnight, Goodnight Construction Site* (Oceanhouse Media, 2014); and *Elmer and the Lost Teddy* (Oceanhouse Media, 2011).

Reading Options in Digital Books

Although there were some distinct differences in the features offered by the publishing companies that produced the high-quality digital books, there were features that were common to both companies (see Table 5), such as

- options for how the story could be read (e.g., read to me, read it myself, autoplay, or some variation of these options);
- access to hotspots embedded within illustration that can be activated by tap, swipe, or changing orientation of the iPad (or device);
- expressive narration;
- sound effects that relate to the content of the story; and
- background music.

The analysis found there were differences between what options were available between the two book app publishing companies. Certain features that are common within Oceanhouse Media digital books included

- ability to record and narrate the story,
- option to turn on and off the reading options,
- option to turn on and off sound effects, and
- option to turn on and off picture read alerts.

There were no common features between the two books from Loud Crow Interactive aside from the reading options and the ability to control volume in the story.

Features	Oceanhouse Media	Loud Crow Interactive
Reading options such as read to me, read it myself, autoplay, or variations of these.	X	X
Embedded hotspots within illustrations activated by tap, swipe, or changing orientation of the iPad.	X	X
Expressive narration	X	X
Sound effects that related to the content of the story	X	X
Background music—option to turn on and off	X	X
Ability to record and narrate the story	X	
Option to turn on/off reading options	X	
Option to turn on/off sound effects	X	
Option to turn on/off picture read alerts	X	
Ability to control volume in the story	X	X

Table 5. Common Features for E-books by Oceanhouse Media and Loud Crow Interactive

Range of Interactive Features in Digital Books

Within the texts that were selected, the analysis of the interactive media effects indicated that there were differences in types of interactivity between series and book app publishing companies. These interactive media features ranged from interactive story with embedded games and numerous hotspots (i.e., *Goodnight Moon*) to simple animation with a number of hotspots focused mainly on vocabulary (e.g., Byron Barton's series) to fairly static stories with hotspots focused on providing vocabulary to objects on the screen (i.e., *Tacky the Emperor* series and *Five Little Monkeys* series).

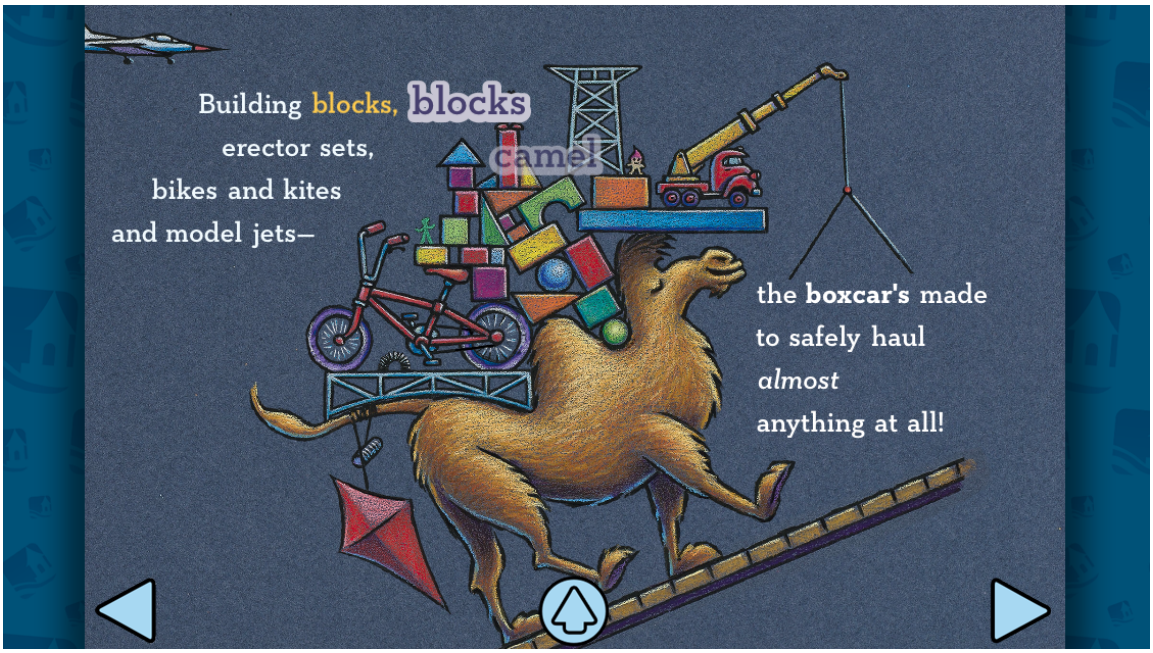
The analysis found the design of the books to be dependent on the digital book app publishing company. While both companies use the illustrations from the original picture books, unique features were added to the digital books. The analysis of the interactive media effects for each screen indicated that for Oceanhouse Media, one of their main effects was vocabulary based. When a reader taps on a hotspot (object or image on the screen/illustration), the reader will simultaneously see the word and hear the word read aloud, and an associated action may occur (e.g., tapping on the iceberg, the word pops up and narrator reads the words [see Figure 4]; tapping on the jet, the word can be seen, heard, and you see it fly off the screen and land back [see Figure 5]).

Figure 4

Screenshot of Interactive Media Effect from Tacky and the Winter Games

Figure 5

Screenshot of Jet in Mid-Animation after Tapping on It from Steam Train, Dream Train



If the reader decides to tap on a number of hotspots at the same time, the words will all appear, and the narrator reads the words in the order that the words were tapped once the narrator finishes reading the page (see Figure 6 and 7). One thing to note about this interactive media effect is that the words will not be read until the narrator finishes reading the text on the page. What this means is that the narrator cannot be disrupted from reading the text; however, the words will pop up during the narration.

Figure 6

Screenshot of Multiple Vocabulary Words Appearing after Tapping on a Number of Hotspots from Elmer and the Lost Teddy

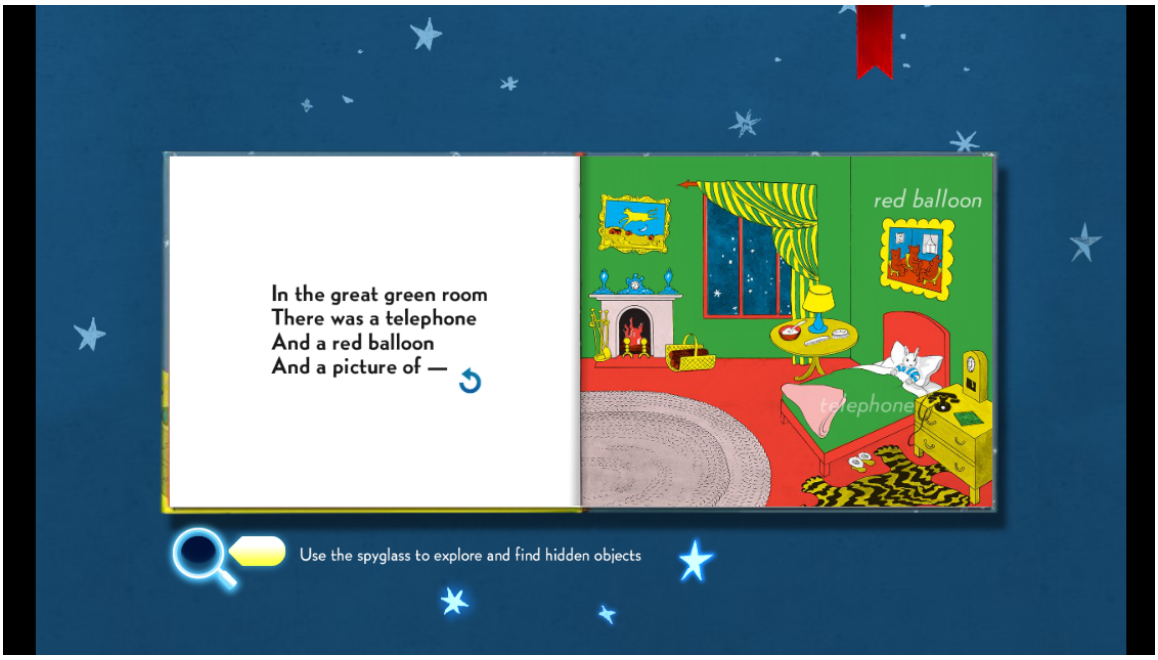
Figure 7

Screenshot of Tapping on Two Hotspots in Trucks

In contrast, Loud Crow Interactive does not offer vocabulary for all of their digital books. Between the two digital books in the study from Loud Crow Interactive, *Goodnight Moon* offers vocabulary words, whereas *Barnyard Dance!* does not. The vocabulary words that appear in *Goodnight Moon* are connected to the text. For example, the first page includes the words red balloon and telephone so when the reader taps on either of those hotspots (e.g., illustration of red balloon and telephone), the word will appear along with a corresponding action. In this case, the red balloon flies away while the word appears, and when a reader taps on the telephone, the handle pops up and the word telephone appears along with the sound of it ringing (see Figure 8).

Figure 8

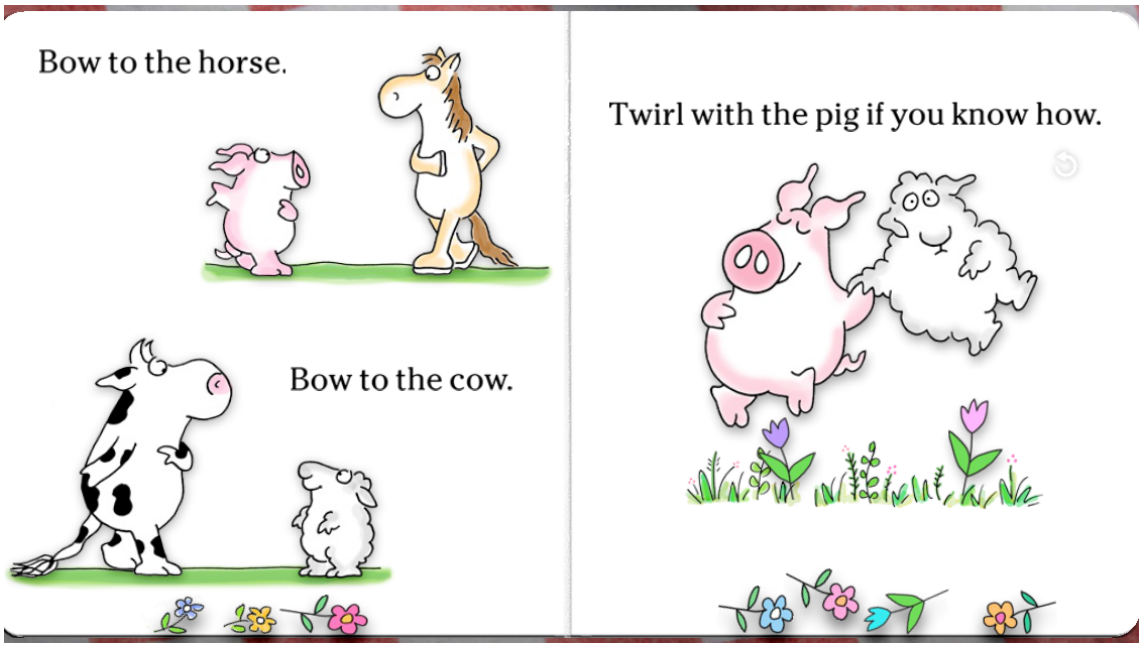
Screenshot of Two Hotspots, Red Balloon and Telephone in Goodnight Moon



One similarity between the two book app publishing companies is that in Loud Crow Interactive books, the reader is able to disrupt narration by tapping on any of the word in the text. Readers are able to tap on any of the text on the page and the narrator will stop reading. Simultaneously, readers are able to tap, swipe, and adjust the orientation of the iPad to affect the story while the narrator is reading (e.g., tap on the flowers, and they pop up and fall to the bottom of the screen. Tilt the screen right or left to move the flowers on the screen; Figure 9). Notably Oceanhouse Media digital book narration will not stop if a reader is tapping on a hotspot (e.g., vocabulary word).

Figure 9

Screenshot of Flowers That Have Fallen onto the Bottom of the Screen and Can Be Moved Around in Barnyard Dance!



One main difference in terms of interactive media effects between the two app publishing companies is that Loud Crow Interactive offers readers more opportunities for ways to interact with the digital books. In the book *Goodnight Moon*, for example, readers have options to take a photo and personalize their digital book, play games such as finding hidden dreamy objects, go on a mouse hunt on each page, or collect stickers (see Figures 10 and 11).

Figure 10

Screenshot of Goodnight Moon*'s Spyglass Game*

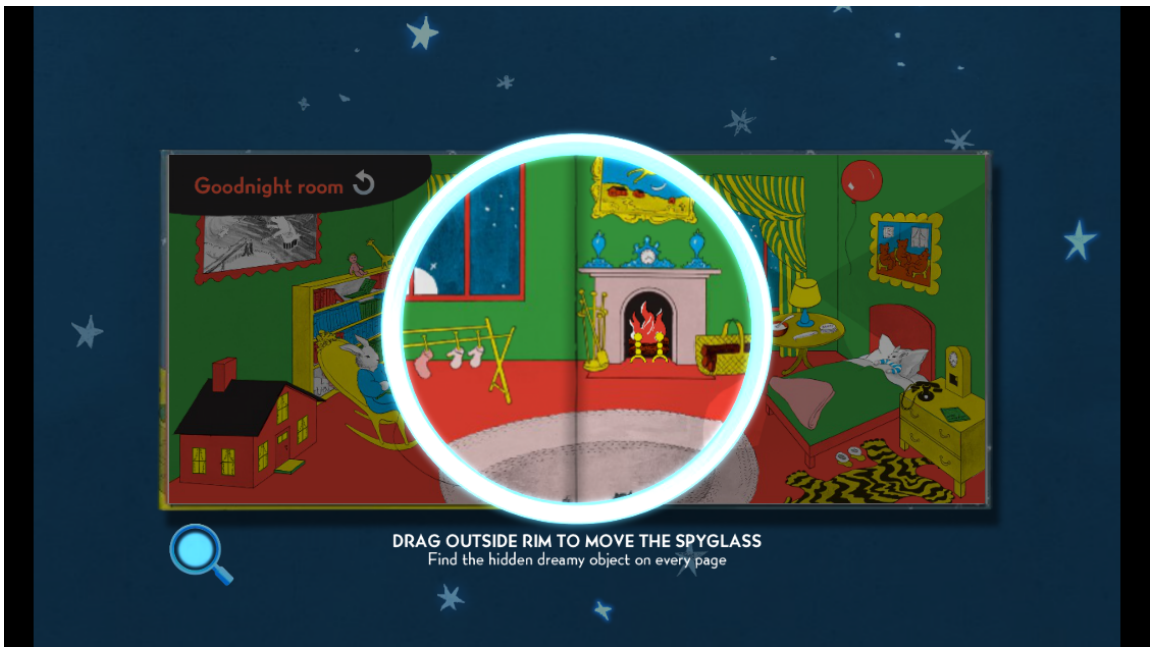


Figure 11

Collecting Stickers in Goodnight Moon *to be Used in the Book to Customize the End Page.*

Similarly, in the digital book *Barnyard Dance!*, readers are able to pluck the flowers and move them around on the screen with their fingers or by moving/shaking the iPad (Figure 9). These types of options are not present in any of the digital books from Oceanhouse Media. One interactive media feature that allows readers to tap/move/swipe objects is the series of books from the Byron Barton, *Boats*, *Planes*, *Trucks*, and *Trains*. In this suite of digital books, readers are able to tap and move objects such as clouds, planes, people, or any objects related to the story. As shown in Figure 12, the reader can move the planes around in the sky. One thing to note is that the reader cannot move the plane onto the sea or on the beach.

Figure 12

Screenshot of Planes Flying Mid-Animation in Planes *by Byron Barton*

Both book app publishing companies offer hotspots that have accompanying sound effects. In the digital book *Elmer and the Lost Teddy* from Oceanhouse Media, when you tap on Elmer, he will make a sound like a trumpet. Similarly, in *Steam Train, Dream Train*, the reader may tap on the bicycle, the wheels will spin, the word bike appears, the narrator reads the word, and you hear clicking sound of the wheels along with a ringing bell (see Figure 5). Although this option is present in all the digital books, not all sound effects are related to the object, animal, or person. In *Barnyard Dance!*, a reader can tap on an animal, and it may make a sound such as a squeak that may not relate to the animal that is being tapped (i.e., pig that oinks or cow that moos).

As such, the range of interactive features found in the digital books that were analyzed largely depended on two things: (a) the book app publishing company and (b) the type of story that has been modified for reading on a digital platform. All of the digital books used illustrations from the original picture book; however, affordances such as animation, sound effects, and hotspots related to the story. Additional hotspots and interactivity were added to the story and, depending on the book app publishing company, certain interactive media effects were highlighted (i.e., Oceanhouse Media with an emphasis on vocabulary and Loud Crow Interactive with an emphasis on features that allowed readers to interact with the story by tapping/pulling/swiping objects in the story).

Relevance of the Categories to the Considerate/Inconsiderate Framework

To answer the second research question, I will discuss it in two parts: first, I will discuss if and how interactive feature categories—integral, incidental, and incongruent—capture the interactive media effects found in digital books (i.e., what interactive features

from the considerate/inconsiderate framework are still effective for e-book classification); second, I will discuss the analysis of the interactive features in relation to the digital books that were selected for this study (i.e., do these terms need to be modified for current digital books?).

The analysis of the interactive features suggests that the three categories from the considerate/inconsiderate framework—integral, incidental, and incongruent—are still effective in classifying digital books. Out of the 20 digital books that were selected for the study, the integral (vital or corresponding), incidental (additional or plausible), and incongruent (disparate and illogical) features were categorized by whether they contributed to relating the story structure. This involved looking primarily at the role and number of the integral and incongruent features in each digital book. The first step involved determining the number of features for each category. Then the numbers were changed into percentages. These percentages were then used to determine how to designate the digital books as either considerate (i.e., supportive of readers' comprehension) or inconsiderate (distracting the reader from comprehension) (Labbo & Kuhn, 2000). If the interactive features met the threshold of 70% or more as supportive of readers' comprehension (i.e., integral or incidental), the text was categorized as considerate (see Table 7). Alternatively, if the interactive features predominantly distracted the reader from developing a coherent sense of the story or met the cutoff point of 30% or more, then the text was deemed inconsiderate. Taken from Labbo and Kuhn's study (2000), 70% was chosen as a cutoff point because when the features in a digital book are integral or incidental, the reader is better able to comprehend the story.

Otherwise, if the reader is faced with over 30% incongruent features, they would need to spend more time negotiating the construction of meaning, thereby increasing demand on their working memory, and would be less likely to do so successfully.

The process of coding and analyzing how each interactive media effect relates to a story element can still be applied to the digital books that were used for this study (see Table 6). Although a majority of the digital books were vocabulary driven, coding each vocabulary word to how it contributed to the quality of the story structure was still effective in classifying these digital books. Given that there were less diverse, interactive features found in these digital books, it is important to note that had there been other interactive features present, this process of coding and analyzing may have been more complicated, thus drawing upon the need to reexamine the considerate/inconsiderate framework in context of the three categories. This piece will be further discussed in the implications section.

Type of Screen	Screen number / interactive feature	Screen features	Story relationship	Story structure / element
AIS	1-0	Background sounds of penguins huffing and puffing while walking. Words:		
	1-1	Sweater	Integral	Setting
	1-2a	Penguin	Integral	character
	1-2b	+tap penguin again, a-huff-and-a-puff shoes	Integral	(sweater, a huff and a puff, headband)
	1-3	headband		
	1-4	iceberg	Integral	
	1-5	ocean	Integral	
	1-6	Nice icy land	Integral	Location
	1-7		Integral	Location
		**swipe left, the screen zooms out to include Tacky in the screen. The text changes to Tacky asking what's up.	Integral	Location
		Words:		
	1-8	Shirt	Integral	Character development
	1-9	Tacky	Integral	
	1-10	Bowtie	Integral	
		**swipe left, text changes		
AIS	2-0	Screen opens up and zooms in on Tacky and the other penguins. You can hear penguins talking and wind blowing. Words: Tap on any penguin you get their names and the word training.		
	2-1a	Goodly,	Integral	Character development
	2-1b	Lovely,	Integral	
	2-2	Angel,	Integral	Character
	2-3	Neatly,	Integral	Character
	2-4	Perfect	Integral	Character
	2-5	Water bottle + sound of opening and drinking water	Integral	
	2-6	Tacky	Integral	Character

2-7	Shoes	Integral	Character
2-8	Bowtie	Integral	development
2-9	Shirt	Integral	
2-10	Headband	Integral	
2-11	sweater	Integral	
2-12	Nice icy land	Integral	Location
2-13	Sky	Integral	Setting
	** swipe left, text changes. ** swipe left, screen zoom to bottom right where there is the illustration of Tacky having training clothes put on him.		

Table 6. Sample of Coding Sheet from *Tacky and the Winter Games*

Using this classification schedule, one hundred percent of the features in the digital book versions of the *Tacky the Penguin* series, the *Five Little Monkeys* series, *Goodnight, Goodnight Construction Site, Elmer and the Lost Teddy*, and *How I Became a Pirate* are integral (see Table 6). As such, these digital books are considered to be considerate texts. For the digital versions of the Byron Barton books, significant percentages of the elements were seen as incidental (*Boats* [20%], *Trains* [16%], *Planes* [24%], and *Trucks* [12%]), whereas the rest of the interactive features were seen as integral. As a result, these four books were classified as considerate. In contrast, although *Goodnight Moon* and *Barnyard Dance!* were deemed considerate, *Goodnight Moon* had the largest number of incongruent features (25%) followed by *Barnyard Dance!* (7.5%), whereas the rest had zero. *Goodnight Moon* also had the largest number of features that were identified as incidental. The proportions of integral and incidental features (i.e., features that support the story) constituted more than half of the total number of features, all the digital books that were analyzed were deemed considerate.

Title	Integral	Incidental	Incongruent	Total unique features
Goodnight Moon	23%	51%	26%	237
Barnyard Dance!	75%	17.5%	7.5%	80
Goodnight, Goodnight Construction Site	100%	0	0	209
Steam Train, Dream Train	99.6%	0.4%	0	264
Elmer and the Lost Teddy	100%	0	0	129
How I Became a Pirate	100%	0	0	202
Boats	80%	20%	0	137
Trains	84%	16%	0	133
Planes	76%	24%	0	124
Trucks	88%	12%	0	154
Tacky the Penguin	100%	0	0	276
Tacky and the Winter Games	100%	0	0	427
Tacky and the Emperor	100%	0	0	356
Tacky Goes to Camp	100%	0	0	351
Tacky's Christmas	100%	0	0	350
Five Little Monkeys Jumping on the Bed	100%	0	0	249
Five Little Monkeys Go Shopping	100%	0	0	215
Five Little Monkeys Play Hide and Seek	100%	0	0	210
Five Little Monkeys With Nothing to Do	100%	0	0	297
Five Little Monkeys Wash the Car	100%	0	0	306

Table 7. Percentages of Integral, Incidental, and Incongruent Features

Reexamination and Application of the Considerate/Inconsiderate Categories for Current Digital Books

To answer the second part of the second research question of whether or not the categories for considerate and inconsiderate framework needs to be modified, this section discusses the types of digital books that were analyzed and how it impacts the need to have new categories. As such, the 20 books that were analyzed did not incorporate a large range of interactive features present in the landscape of digital books. This means that, for a complete array of digital books and their interactive features, a more diverse range

of digital books from a wide variety of book app publishing companies will need to be evaluated in order to provide a comprehensive investigation into the features found in current digital books. From that, I will then be able to determine whether the categories from the considerate and inconsiderate framework may need to be modified. However, to answer the question based on the 20 digital books that were identified for the study, there is no need to modify the categories because the interactive features found in these digital books were able to be coded as being integral, incidental, and incongruent, thereby allowing a determination of whether or not the digital books are considerate or inconsiderate.

Chapter Summary

Findings from the analysis of interactive media effects found in high-quality digital books provide information on the types of interactive features available in these texts, the relevancy of the categories in the considerate/inconsiderate framework, and the ways these findings may inform an evaluative tool for teachers. The evaluated digital book versions of high-quality printed books came from two book app publishing companies: Oceanhouse Media and Loud Crow Interactive. As such, the range of interactive features present in these digital books was tied closely to which company published the text. For example, Oceanhouse Media digital books included features such as hotspots that were focused on vocabulary with corresponding sound effects, whereas Loud Crow Interactive digital books included features such as the option to change orientation of the iPad to affect objects on the screen and to engage in tap/swipe/pull

interactivity with hotspots. The categories from the considerate/inconsiderate framework (i.e., integral, incidental, and incongruent) are still effective in classifying these high-quality digital books. For these selected digital books, there does not seem to be a need to modify the categories for the considerate/inconsiderate framework because it was possible to apply these terms to determine whether each interactive media effect supported the story and its story structure. Lastly, due to the accurate analysis of each interactive media effect and its relation to story structure in supporting a reader's comprehension, findings from this content feature analysis can begin to inform an evaluation tool to help teachers select high-quality digital books in order to support students' meaning making.

CHAPTER FIVE: DISCUSSION

In this study, I set out to identify and characterize interactive features found in high-quality digital versions of picture books and to determine whether the considerate and inconsiderate framework still applied to those digital texts. I chose this particular topic as a way to address the sparse literature on the quality of digital books (Korat & Shamir, 2004; Yokota & Teale, 2014) read on mobile platforms: specifically iPad and iPhone. As I stated in Chapter 1, research on the quality of digital books has solely been conducted on outdated technology (e.g., desktop computers) (Bus, Takacs, & Kegel, 2014; De Jong & Bus, 2002; Salmon, 2013; Smeets & Bus, 2013). As digital tools, such as digital books, become more prevalent in and out of schools today and portable devices become more ubiquitous, it becomes increasingly critical to examine how these tools support literacy learning for young children. As such, an updated content feature analysis on digital books read on portable devices would serve to inform the field. The present study addressed these questions through a content feature analysis that was conducted on high-quality digital books. Using Armbruster and Anderson's (1984) considerate/inconsiderate framework and Mandler and Johnson's (1977) story structure categories, the analysis served to characterize digital books read on mobile devices; provide insights on high-quality digital books and their interactive features; and determine whether the considerate/inconsiderate framework can still be used to categorize digital books.

In the sections that follow, I will interpret the findings in relation to the patterns of interactive features that emerged within and across book app publishing companies and

discuss how the considerate and inconsiderate framework continues to be effective in classifying digital books. Then, I will discuss the limitations of the study. Finally, I will suggest implications for theory, research, and educational contexts.

Uniformity Across Digital Books

The results from the present study confirm findings from De Jong and Bus's study (2003) about lacking uniformity across digital books. De Jong and Bus's study evaluated 55 Dutch e-books and five English e-books. They found there was little consistency in terms of options and features. De Jong and Bus's findings are echoed in the present study. Although there were positive findings from the study on the types of features integrated into high-quality digital books, the difference is largely based on which digital app publishing companies were producing them. One implication from this particular finding is that within the offerings of a book app publishing company there are consistencies in terms of the reading options, format, and interactive features found in their books. Firstly, this means that a reader could choose books based purely on book app publishing companies and expect consistency: the digital book will likely be of a similar quality and offer the same range of interactive features. Although the present study examined a small sample across book app publishing companies, I can say with certainty that (n = 18) digital books produced by Oceanhouse Media offer similar options and features. However, due to the small sample size in the present study, it appears that *across* book app publishing companies there are differences in the range of interactive features offered. As a result, it is critical that more studies should be conducted on the quality of digital books *because* there is a lack of uniformity across digital books

produced by different book app publishing companies.

Number of Unique Features and Their Relation to Interactivity

Out of the research literature on digital books, it is important to look critically at patterns, especially regarding the number of unique features and their roles in how we read digital books. A finding from my study indicated that the number of unique features does *not* contribute to the designation of a book as considerate or inconsiderate. An example of the number of unique features and their impact on supporting story structure can be seen by the book *Tacky and the Winter Games*, which had a large number of 427 unique features, compared to *Barnyard Dance!*, which offered only 80 unique features. What is interesting about this is that *Barnyard Dance!*, with its lower number of unique features, offered more interactivity (i.e., move animals around to dance, pick flowers, orient iPad to change direction of flowers, etc.) than *Tacky and the Winter Games*, in which hotspots are focused mostly on vocabulary words. As I have stated, there are patterns of unique features that are present within the product lines of book app publishing companies. Oceanhouse Media focused on providing readers opportunities to learn vocabulary, whereas Loud Crow Interactive focused on format. What I mean by *format* is opportunities for readers to tap and interact with the characters of the story (i.e., make them dance, hatch a chicken, etc.). An example of what this looks like is in *Barnyard Dance!* is that a reader can tap on the violin the cow is holding to see the cow play the violin. The visual image is accompanied by the action, the playing of the violin, alongside the sound of the violin. The action and sound effects in the one hotspot can lend themselves to meaning making for young children as well as distract them because

there is no time limit to prevent them from repeatedly tapping on the violin to hear the music. So, the number of unique features does not inform the level of interactivity found in digital books, nor does it contribute to the designation of them as being either considerate or inconsiderate.

Limitations of the Study

While this study, using clearly defined criteria for high-quality digital books, offers positive preliminary findings as to what constitutes high-quality digital books, it is not without limitations. The biggest limitation of this study were the selection criteria. Selecting only high-quality digital book versions of printed picture books using *The Horn Book Guide Online* as a measure limited the range of digital books and, therefore, limited the interactive features studied compared to those available on the market. The selection criteria meant that only two book app publishing companies were represented in the study, with a majority from Oceanhouse Media and a small sample from Loud Crow Interactive. One way to address this limitation is to redefine what high-quality looks like solely for digital books. This process may entail a review of digital books created by a variety of book app publishing companies.

The second limitation to the study is twofold, the first being the effect of the selection criteria. I included as many digital books that fit the selection criteria as possible in order to gather a range of interactive features. As a result, digital books that may not be classified as true narrative texts were considered in the study. These simple texts presented the second limitation, which was confined to the considerate/inconsiderate framework that has been informed by Mandler and Johnson's

(1977) notion of story structure. The books from Byron Barton's series (*Planes*, *Trains*, *Boats*, and *Trucks*) were identified as being high-quality books that had a digital version. However, these simple books do not contain a story arc, so analyzing each interactive feature's relevance to a story structure or element proved to be complicated. Essentially, each hotspot was analyzed in relation to the simple stories. One way to address this issue is to not include simple stories into studies of this nature. The other suggestion is to revise the considerate/inconsiderate framework in a manner that would address other genres such informational and nonfiction texts. Including other types of stories would allow for a larger review of digital books and types of unique features.

Despite the limitations, the preliminary findings suggest that when a digital book offers a large percentage of hotspots focused on supporting vocabulary and sound effects or actions that appropriately correspond to objects/animals/actions, it is identified as a considerate text and may aid in comprehension for young readers. Secondly, although the limited selection of digital books did not allow for a comprehensive examination of a variety of unique features, the present study did identify which types of interactive features can contribute to supporting young readers. In turn, these findings will inform the creation of an evaluation tool to assist teachers in selecting digital books to support younger learners.

Implications

Theory

Children today are inundated with technology. In fact, recent headlines indicate how commonly children have access to or are placed in front of a screen such as a tablet

or smartphone. Researchers have been asking questions about what constitutes the appropriate amount of screen time (e.g., Gander, 2019; Hermitanio, 2019; Jones, 2018). Even the use of the term *screen time* indicates how our language is being adjusted for technology, especially how it has shaped how we interact with each other, texts, and images. As I mentioned in Chapter 1, 95% of families with kids up to eight years old have access to a smartphone (Rideout, 2017). These digital tools will play a role in children's lives in and out of school. Within that context, reading conventions are changing to reflect the use of technology. Knobel and Lankshear (2014) have observed that as readers negotiate meaning through interactive features and new technology, we, as researchers, need to better understand how this is changing the nature of how we read on screens. To that end, future research will need to continually reflect the changing technology by analyzing, identifying, and re-imagining the role of multimodal devices and how the interactive features are affecting how children read on screens, especially in digital books.

Research

My study analyzed each high-quality digital book by critically examining each individual unique feature to determine the types of interactive features offered on mobile devices. In fact, carefully analyzing each unique feature in the context of the three categories necessitated raising a few questions. The first of these questions stemmed from my analysis of *Goodnight Moon.* Can a digital book be identified as being considerate with such a high number of incidental interactive features alongside a high number of incongruent features? The digital book *Goodnight Moon* offered 237 unique features, and

50% of those features were deemed as incidental. As such, this particular finding raises an important question about the role of incidental features, especially if more than half of the features have been coded as incidental (i.e., action that is additional or plausible). Another question raised by the study was a reconsideration of how to code for multiple actions associated with one hotspot. An example of this is of the red balloon (from *Goodnight Moon*): the vocabulary word appears, which is coded as integral; the sound effect that accompanies it is incidental; and the actions of the red balloon, floating off the screen to reappear, are also incidental. The combination of all three actions were coded as incidental; however, it is important to consider how this particular hotspot has a potential to disrupt the story because there is no limit to the amount of time a reader can spend with the given effect.

Future research on unique interactive features may need to include other digital books that offer multiple actions for an individual hotspot and code them to see if there is a pattern in total percentages of incidental, integral, or incongruent features. It may be necessary to re-examine the role of percentages within each category, especially if 50% or more of the features are coded as incidental. A suggestion would be to re-examine the cutoff point. Currently, if 30% or more interactive features were coded as incongruent and 50% were coded as incidental, the current precedent based on Labbo and Kuhn's study (2000) would designate the book as being considerate. However, knowing what we know about the role of incidental features in meaning making, it may make sense to re-evaluate their role in identifying a book as considerate or inconsiderate, especially if more than half of the features are coded as incidental.

My study has identified interactive features in high-quality digital books; as such, I am able to inform an evaluation tool in order for teachers to select high-quality digital books to support young children's comprehension. The next logical step is to take a look at a larger range of digital books, such as versions of low-quality printed picture books and digital books that do not have a printed version, in order to compare and determine how each type differs as well as to analyze more broadly the types of interactive features present in digital books. It remains to be seen what types of approaches book app publishing companies are taking when they are not held to the confines of a printed picture book or a pre-existing story.

A second direction to further this research is to conduct a study with a variety of students reading high-quality digital books that have been analyzed using the methods of the present study to identify them as being considerate or inconsiderate. By conducting a case study with a large group of children in early elementary grades (e.g., first or second grade), we can begin to see the types of reading strategies or processes these students are using when reading high-quality digital books. Additionally, conducting a study with English Language Learners could help to determine whether certain interactive features support reading components such as decoding, fluency, or vocabulary (e.g., many digital books focus on vocabulary and expressive narration). Lastly, building on the recommendations for the last two studies, conducting research with strategic readers could help to determine what types of reading strategies they are using to make sense of the story while reading inconsiderate texts.

As more research is being conducted on how technology could support reading, it

is important to remember the quality of digital books that are being used in these studies. When digital books and their interactive features are evaluated, we can then begin to see whether the affordances offered by digital books can meaningfully support reading development for young children.

Educational Contexts

The findings from the present study could support the development of an evaluative tool that would help teachers, librarians, and literacy researchers decide whether a digital book would readily support students' understanding of story grammar. As an evaluation tool for teachers and librarians, they could use it to determine whether a digital book would support literacy learning for young children. A secondary use for the evaluation tool could be to inform the work of future literacy researchers by defining and identifying digital book features as well as building a common language around research on digital books.

The analysis yielded lists of interactive features that designate a digital book considerate or inconsiderate. Accordingly, the common features characterizing considerate texts could become the criteria points by which an educator could evaluate digital books to decide whether or not to include them in their libraries. Below, I will discuss the common interactive features characterizing high-quality digital books and how they might be assembled into a checklist or decision tree that could ultimately serve as such an evaluative tool.

An Evaluation Tool

The first step in developing an evaluation tool is to identify the interactive features that have been coded as integral in the high-quality digital books. Analysis of the interactive media effects from the 20 digital books revealed that the following options offered in digital books and interactive features are integral:

- expressive narration of the story;
- narration that cannot be disrupted by activation of hotspots;
- hotspots that link the vocabulary in the story;
- sound effects embedded in hotspots that correspond with vocabulary words, objects, animals, or people;
- hotspots that allow the reader to move objects around and actions correspond to the actual or plausible actions within the story structure;
- hotspots that correspond/support the story structure;
- an option to turn on and off reading sound effects; and
- an option to turn on and off interactive features.

The second step is to provide another list that synthesizes these points into larger categories such as narration, hotspots, options, and sound effects. Below each category would be specific criteria points. Teachers would then be able to take a look at this evaluation tool and check off whether or not the digital book they are examining contains the following integral features (see Table 8).

Narration	Hotspots	Options	Sound effects
☐Expressive narration	☐Hotspots that link the vocabulary in the story	☐An option to turn on and turn off interactive features	☐Sound effects embedded in hotspots that correspond with vocabulary words, objects, animals, or people
☐Narration that cannot be disrupted by activation of hotspots	☐Hotspots that allow the reader to move objects around and actions correspond to the actual or plausible actions within the story structure ☐Hotspots that correspond/support the story structure	☐An option to turn on and turn off reading sound effects	

Table 8. Example of What an Evaluation Tool Might Look Like

These options and interactive features found in high-quality digital books may serve as the criteria points that would support teachers and librarians in selecting digital books for classroom and library use. Findings from the present study offer a small sample for informing an evaluative tool. More digital books will need to be analyzed using the considerate/inconsiderate framework to determine whether the findings from the present study hold true for other types of digital books.

The last study that conducted a content feature analysis on e-books occurred in 2004. My study is the first in over 10 years to conduct a content feature analysis on digital books read on mobile devices. My findings inform and extend upon the literature on high-quality digital books and their interactive features.

This study identified two gaps in the literature on digital books: measures to

determine if digital versions of high-quality picture books support literacy development for young children and measures to evaluate and select digital books for classroom use. My study answers these gaps by identifying high-quality interactive features and with that has expanded on previous studies on interactive features that can support literacy development for young children. Additionally, the findings from my study contribute to the growing knowledge on digital book features and how they can be used to inform a tool for teachers to select digital books for classroom use.

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